

What is claimed is:

1. An automatic focus adjusting device comprising:  
extracting means for extracting a focus signal corresponding to a degree of focus from a picked-up image signal outputted from image pickup means;  
a focusing lens to be used for focus adjustment; and  
direction deciding means for deciding a driving direction of said focusing lens on the basis of the focus signal outputted from said extracting means when said focusing lens deviates from an in-focus state, and  
wherein said extracting means is arranged to extract a plurality of focus signals having different frequency components, and wherein said direction deciding means is arranged to separately compute the driving direction of said focusing lens relative to each of the plurality of focus signals and to decide the driving direction of said focusing lens on the basis of a plurality of results of computing operation on the plurality of focus signals.
2. A device according to claim 1, wherein, when the plurality of results of computing operation come to coincide with each other, said direction deciding means is arranged to decide a direction indicated by the plurality of results of computing operation as the driving direction of said focusing lens.

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3. A device according to claim 2, wherein said direction deciding means is arranged to repeat a direction deciding action thereof until the plurality of results of computing operation come to coincide with each other.

4. A device according to claim 3, wherein said direction deciding means includes wobbling means arranged to relatively vibrate said focusing lens and said image pickup means to a minute extent in the direction of an optical axis.

5. A device according to claim 1, wherein said plurality of focus signals have different frequencies from each other.

6. An automatic focus adjusting device comprising:  
 extracting means for extracting a focus signal corresponding to a degree of focus from a picked-up image signal outputted from image pickup means;  
 storing means for storing the focus signal extracted by said extracting means;  
 a focusing lens to be used for focus adjustment;  
 direction deciding means for deciding a driving direction of said focusing lens on the basis of the focus signal outputted from said extracting means when said focusing lens deviates from an in-focus state;  
 detecting means arranged to compare the level of the focus signal stored in said storing means with the level of the focus signal extracted by said extracting means and to detect a difference between the levels of the focus signals;

monitoring means for monitoring a temporal change of the difference between the focus signals detected by said detecting means; and

control means for causing said direction deciding means to decide the driving direction of said focusing lens either after an amount of change of the focus signal is determined to be small by said monitoring means or after the level of the focus signal extracted by said extracting means is determined to exceed a predetermined value.

7. A device according to claim 6, wherein the focus signal corresponds to a high frequency component included in the picked-up image signal.

8. A device according to claim 7, wherein said extracting means comprises a plurality of band-pass filters having different passbands from each other.

9. A device according to claim 8, wherein said monitoring means is arranged to monitor whether the difference between the focus signals detected by said detecting means has become stable.

10. A device according to claim 6, wherein said direction deciding means includes wobbling means arranged to relatively vibrate said focusing lens and said image pickup means to a minute extent in the direction of an optical axis.

11. A device according to claim 10, wherein said control means is arranged to control the timing of commencement of an action of said wobbling means on the basis of an output of said monitoring means.

12. An automatic focus adjusting device comprising:

extracting means for extracting a focus signal corresponding to a degree of focus from a picked-up image signal outputted from image pickup means;

in-focus state deciding means for deciding an in-focus state on the basis of the focus signal extracted by said extracting means;

storing means for storing the focus signal extracted by said extracting means;

a focusing lens to be used for focus adjustment;

direction deciding means for deciding a driving direction of said focusing lens on the basis of the focus signal outputted from said extracting means;

detecting means arranged to compare the level of the focus signal stored in said storing means with the level of the focus signal extracted by said extracting means and to detect a difference between the levels of the focus signals; and

control means for controlling an action of said direction deciding means according to a temporal change of the difference between the focus signals detected by said detecting means when said focusing lens deviates from an in-focus state.

13. A device according to claim 12, wherein said control means is arranged to decide a state of panning from the difference between the focus signals detected by said detecting means when said focusing lens deviates from an in-focus state and to make reference a plurality of times to an output of said detecting means before the driving direction of said focusing lens is decided by the action of said direction deciding means.

14. A device according to claim 13, wherein said control means is arranged to make a decision as to whether said focusing lens is in an in-focus state or said focusing lens should be restarted, on the basis of results of reference made a plurality of times to the output of said detecting means.

15. A device according to claim 12, wherein said direction deciding means includes wobbling means arranged to relatively vibrate said focusing lens and said image pickup means to a minute extent in the direction of an optical axis.

16. An automatic focus adjusting device comprising:

- extracting means for extracting a focus signal corresponding to a degree of focus from a picked-up image signal outputted from image pickup means;
- storing means for storing the focus signal extracted by said extracting means;
- a focusing lens to be used for focus adjustment;
- a variator lens to be used for varying a magnifying power;
- first direction deciding means for deciding a driving direction of said focusing lens on the basis of the focus signal outputted from said extracting means when said focusing lens deviates from an in-focus state;
- second direction deciding means, arranged separately from said first direction deciding means, for deciding the driving direction of said focusing lens on the basis of the focus signal extracted by said extracting means;
- focusing lens position detecting means for detecting the position of said focusing lens;

variator lens position detecting means for detecting the position of said variator lens; and

control means arranged to decide the driving direction of said focusing lens by selecting either said first direction deciding means or said second direction deciding means according to the focus signal extracted by said extracting means, an output of said focusing lens position detecting means and an output of said variator lens position detecting means.

17. A device according to claim 16, wherein said first direction deciding means is arranged to decide the driving direction of said focusing lens according to the level of the focus signal which is caused to vary by minutely driving said focusing lens in one direction, and wherein said second direction deciding means is arranged to decide the driving direction of said focusing lens by vibrating said focusing lens back and forth in a predetermined cycle in the direction of an optical axis.

18. A device according to claim 17, wherein said control means is arranged to have the driving direction of said focusing lens decided by said direction deciding means which decides the driving direction by wobbling when the position of said variator lens is on the side of a telephoto end position thereof, or when the focus signal varies to a large extent, or when the position of said focusing lens is on the side of a nearest distance position thereof.

19. A device according to claim 17, wherein said control means is arranged to have the driving direction of said focusing lens decided by said first direction deciding

means when the position of said variator lens is on the side of a wide-angle end position thereof, or when the focus signal varies to a small extent, or when the position of said focusing lens is in the neighborhood of an infinity distance position thereof.

20. An automatic focus adjusting device comprising:

extracting means for extracting a focus signal corresponding to a degree of focus from a picked-up image signal outputted from image pickup means;

storing means for storing the focus signal extracted by said extracting means;

a focusing lens to be used for focus adjustment;

direction deciding means for deciding a driving direction of said focusing lens on the basis of the focus signal outputted from said extracting means when said focusing lens deviates from an in-focus state; and

control means for varying the timing of commencement of an action of said direction deciding means on the basis of predetermined information supplied from outside.

21. A device according to claim 20, wherein the information supplied from outside is information on a state of panning.

22. A device according to claim 20, wherein the information supplied from outside is information on a state of tilting.

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23. A device according to claim 21 or 22, wherein the information supplied from outside is information on detection of an image shake which is outputted from image shake correcting means.

24. An automatic focus adjusting device comprising:  
extracting means for extracting a sharpness signal corresponding to sharpness from a video signal;  
driving means for driving a focusing lens;  
position detecting means for detecting the position of said focusing lens;  
control means arranged to cause said focusing lens to be driven by controlling said driving means according to the level of the sharpness signal, to store the position of said focusing lens obtained when the level of the sharpness signal reaches a maximum value and to have said focusing lens driven to the stored position of said focusing lens by causing a driving direction of said focusing lens to be reversed when the sharpness signal decreases from the maximum value by a predetermined level; and  
level control means for varying the predetermined level according to information on a state of driving said focusing lens.

25. A device according to claim 24, wherein said sharpness signal is a high frequency component of a video signal.

26. A device according to claim 24, wherein the information on the state of driving said focusing lens is a number of times for which the driving direction of said focusing lens have been reversed.



27. An automatic focus adjusting device comprising:
- extracting means for extracting a sharpness signal corresponding to sharpness from a video signal;
  - driving means for driving a focusing lens;
  - position detecting means for detecting the position of said focusing lens;
  - control means arranged to cause said focusing lens to be driven by controlling said driving means according to the level of the sharpness signal, to store the position of said focusing lens obtained when the level of the sharpness signal reaches a maximum value and to have said focusing lens to be driven to the stored position of said focusing lens by causing a driving direction of said focusing lens to be reversed when the sharpness signal decreases from the maximum value by a predetermined level; and
  - level control means arranged to vary the predetermined level according to information on the reversal of the driving direction of said focusing lens and to decrease the predetermined level when the driving direction of said focusing lens have been reversed at least a predetermined number of times.

28. A device according to claim 27, wherein said sharpness signal is a high frequency component of a video signal.

29. An automatic focus adjusting device comprising:
- extracting means for extracting a sharpness signal corresponding to sharpness from a video signal;
  - driving means for driving a focusing lens;

position detecting means for detecting the position of said focusing lens;

control means arranged to cause said focusing lens to be driven by controlling said driving means according to the level of the sharpness signal, to store the position of said focusing lens obtained when the level of the sharpness signal reaches a maximum value and to have said focusing lens driven to the stored position of said focusing lens by causing a driving direction of said focusing lens to be reversed when the sharpness signal decreases from the maximum value by a predetermined level; and

level control means for varying the predetermined level according to information on a state of driving said focusing lens and on the depth of field.

30. A device according to claim 29, wherein said sharpness signal is a high frequency component of a video signal.

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